4 Conclusions

The effects of heat transfer through the cylinder wall on the performance of the Atkinson and the Dual combustion cycle are investigated in this study. The relation between net-work output and thermal efficiency is derived. Furthermore, the maximum work output and the corresponding thermal efficiency at the maximum work output are also are derived. In the analyses, the influence of four significant parameters, namely the heat transfer and combustion constant, compression ratio and intake air temperature on the net-work output versus efficiency characteristic, and the maximum work and the corresponding efficiency at maximum work are examined. Comparisons of the performances of the air-standard Atkinson and the Dual combustion cycles with heat transfer considerations are also discussed. The general conclusions drawn from the results of this work are as follows:

1. The maximum work output and the corresponding efficiency at maximum work output decreases as the heat transfer constant β increases.
2. The maximum work output and the corresponding efficiency at maximum work output increases as the combustion constant α increases.
3. The maximum work output and the corresponding efficiency at maximum work output decreases as the intake temperature (T_1) increases.
4. For a given value of heat release during combustion (α) an increase in heat loss (β) leads to a decrease of the compression ratio (r_{cm}) that maximizes the work of the Atkinson cycle.

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Nomenclatures

a_1: constant defined in equation (15)
a_2: constant defined in equation (15)
a_3: constant defined in equation (15)
b_1: constant defined in equation (31)
b_2: constant defined in equation (31)
b_3: constant defined in equation (31)
b_4: constant defined in equation (31)
b_5: constant defined in equation (31)
C_p: constant pressure specific heat (kJ/kg – K)
C_v: constant volume specific heat (kJ/kg – K)
k: $k = C_p/C_v$
q_{in}: heat added per unit mass to working fluid (kJ/kg)
r: cut-off ratio
r_c: compression ratio
r_{cm}: compression ratio at maximum work
s: specific entropy (kJ/kg – K)
r_p: pressure ratio
T_i: temperature at state i (K)
V_i: volume at state i (m^3)
w: net work output per unit mass (kJ/kg)
w_{max}: maximum work output per unit mass of working fluid per cycle (kJ/kg)

Greek symbols

α: constant related to combustion (kJ/kg)
β: constant related to heat transfer (kJ/kg – K)
η: efficiency
η_m: corresponding thermal efficiency at maximum work output

چکیده

در هنگام فرآیندهای موتورهای واقعی، مقداری گرمای تلف شده وجود دارد که در تحلیل ایده‌آل این موتورها در نظر گرفته نمی‌شود. در این مقاله، اثر انتقال حرارت روی کار خالص خروجی و بازده حرارتی چرخه استاندارد هوایی آتکینسون و چرخه احتراق دوگانه بررسی شده است. همچنین عملکرد چرخه‌های آتکینسون و دوگانه نیز با هم مقایسه شده است. فرض شده است که مراحل تراکم و قدرت بی‌دررو و برگشت‌پذیر و بدون هیچ نوع انتقال حرارتی (اعم از جابجایی، همرفت و تشعشعی) به دیواره سیلندر باشد. فقط اتلاف حرارتی صورت گرفته از طریق دیواره سیلندر در مرحله احتراق در نظر گرفته شده است. نتایج بدست آمده نشان می‌دهد که کار خالص خروجی در برابر بازده و کار خروجی بیشینه در برابر بازده وابسته به آن تا حد زیادی تحت تأثیر مقدار انتقال حرارت می‌باشد. نتایج این بررسی می‌تواند به عنوان یک راهنمای مناسب برای بررسی عملکرد موتورهای واقعی مورد استفاده قرار گیرد.